Testimony of
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Chairman Boehlert, Ranking Member Gordon, and members of the Committee, thank you for this opportunity to discuss NSF's FY 2006 budget Request. It is a pleasure to appear before you today. For over fifty years, NSF has been charged with being a strong steward of the scientific discovery and innovation that has been crucial to increasing America's economic strength, global competitiveness, national security, and overall quality of life.

For many years, the United States economy has depended heavily on investments in research and development – and with good reason. America's sustained economic prosperity is based on technological innovation made possible, in large part, by fundamental science and engineering research. Innovation and technology are the engines of the American economy, and advances in science and engineering provide the fuel.

Investments in science and technology – both public and private – have driven economic growth and improved the quality of life in America for the last 200 years. They have generated new knowledge and new industries, created new jobs, ensured economic and national security, reduced pollution and increased energy efficiency, provided better and safer transportation, improved medical care, and increased living standards for the American people. Innovation and technology have become the engines of the American economy, and advances in science and engineering provide the fuel.

Investments in research and development are among the highest-payback investments a nation can make. Over the past 50 years technological innovation has been responsible for as much as half of the nation's growth in productivity.

Sustaining this innovation requires an understanding of the factors that contribute to it. The Council on Competitiveness, a consortium of industry, university, and labor leaders, has developed quantitative measures of national competitiveness: the number of R&D personnel in the available workforce; total R&D investment; the percentage of R&D funded by private industry; the percentage of R&D performed by the university sector; spending on higher education; the strength of intellectual property protection, openness to international competition; and per capita gross domestic product. A similar set of indicators has been developed by the World Bank Group, and voluminous data have been compiled by NSF. The important point

underscored by these indicators is that, for America to remain a prosperous and secure country, it *must* maintain its technological leadership in the world.

Perhaps the Council on Competitiveness' 2004 *National Innovation Initiative* report captured it best by simply stating, "Innovation has always been the way people solved the great challenges facing society."

Often times, the connection between an area of research, or even a particular scientific discovery, and an innovation may be far from obvious. Fundamental research in physics, mathematics and high-flux magnets supported by NSF led to the development of today's Magnetic Resonance Imaging (MRI) technology. Today, MRIs are used widely to detect cancer and internal tissue damage. Fundamental research on extremophiles, or microorganisms living in extreme environments, led to the polymerase chain reaction, a procedure paramount to modern biotechnology, as well as one that allows us to use DNA for forensic evidence. Continuing progress in basic science and engineering research promises more discoveries as well as further improvements in living standards and economic performance.

And still, science and engineering is becoming an ever-larger portion of our nation's productivity. In the early 1950s, Jacob Bronowski wrote, "The world today is powered by science." I would take this premise one step farther, "No science; no economic growth." Our current level of scientific and technological productivity is what keeps us ahead of our global competitors as the playing field continues to become more level.

NSF has helped advance America's basic science and engineering enterprise for over fifty years. Despite its small size, NSF has an extraordinary impact on scientific and engineering knowledge and capacity. While NSF represents only four percent of the total federal budget for research and development, it accounts for 50 percent of non-life science basic research at academic institutions. In fact, NSF is the *only* federal agency that supports *all* fields of science and engineering research and the educational programs that sustain them across generations. NSF's programs reach over 2,000 institutions across the nation, and they involve roughly 200,000 researchers, teachers, and students.

NSF specifically targets its investments in fundamental research at the frontiers of science and engineering. Here, advances push the boundaries of innovation, progress and productivity.

Compared to other commodities, knowledge generated from basic science investments is unique, long lasting and leverages on itself. Knowledge can be shared, stored and distributed easily, and it does not diminish by use. Incremental advances in knowledge are synergistic over time. NSF is proud to have built the foundation for this knowledge base through decades of peer-reviewed, merit-based research.

FY 2006 Budget Request

The Foundation's FY 2006 budget Request reflects the Administration's confidence in our continuing with this mission. In light of the tight fiscal climate, NSF fared relatively well. For the coming fiscal year, NSF requests $5.6 billion, an increase of $132 million, or 2.4 %, over last year's appropriated levels.

At a time when many agencies are looking at budget cuts, an increase in our budget underscores the Administration's support of NSF's science and engineering programs, and reflects the agency's excellent management and program results.

With the wealth of benefits that investments in science and engineering bring to the nation, perhaps none is more powerful than the capability to respond quickly and effectively to challenges of all kinds. NSF's programs reach over 2,000 institutions across the nation, and they involve researchers, teachers, and students in all fields of science and engineering and at all levels of education. They also keep us abreast of scientific advances throughout the world. This breadth of activity in and of itself creates a vital national resource, as it provides the nation with a constantly invigorated base of knowledge, talent, and technology. For example, in areas ranging from terrorism threats to natural disasters, NSF's ongoing support of research in areas such as advanced information technologies, sensors, and earthquake engineering ensures a broad base of expertise and equipment that allows the science and engineering community to respond quickly in times of need and in partnership with scientists and engineers from other countries.

Four funding priorities centering this year's request are designed to address current national challenges and strengthen NSF's core research investments. They include: (1) Strengthening core disciplinary research; (2) Providing broadly accessible cyberinfrastructure and world-class research facilities; (3) Broadening participation in the science and engineering workforce; and (4) Sustaining organizational excellence in NSF management practices.

This year's investments will strengthen the core disciplines that empower every step of the process from discovery at the frontier to the development of products, processes, and technologies that fuel the economy. At the same time, NSF's investments will enable increasing connections and cross-fertilization among disciplines.

NSF's focus on a clear set of priorities will help the nation meet new challenges and take advantage of promising opportunities, while at the same time spurring the growth and prosperity needed to secure the nation's long-term fiscal balance. The FY 2006 budget will emphasize investments that address established interagency research priorities, meet critical needs identified by the science and engineering community, and advance the fundamental knowledge that strengthens the nation's base of innovation and progress. NSF will respond to these challenges by supporting the best people, ideas, and tools in the science and engineering enterprise, and by employing the best practices in organizational excellence.

Research and Related Activities Account

For FY 2006, total funding for NSF's Research and Related Activities account increases by $113 million – nearly three percent – to $4.33 billion. This increase largely reflects NSF efforts to strengthen fundamental research in the core scientific disciplines as well as promote emerging areas of research. The FY 2006 portfolio balances research in established disciplines with research in emerging areas of opportunity and cross-disciplinary projects. The most fertile opportunities sometimes lie in novel approaches or a collaborative mix of disciplines.

Maintaining a strong and robust core is critical during such a budget climate as certain segments of the academic community rely heavily on NSF funding. In many scientific disciplines, NSF is a major source of federal funding to academic institutions, including mathematics (77 percent), computer sciences (86 percent), the social sciences (49 percent), the environmental sciences (50 percent), engineering (45 percent) and the physical sciences (39 percent).

Research, however, is only part of the NSF equation. Training the nation's next generation of scientists and engineers is another key component of NSF's mission, and critical for maintaining economic prosperity and global competitiveness. Here, we are finding ways to leverage our resources. For example, as we strengthen our core disciplinary research programs, we will continue to encourage the types of partnerships between researchers and students that provide hands-on experience while ensuring that future generations gain the skills, knowledge and insight that come from working at the frontier of discovery.

Providing Broadly Accessible Cyberinfrastructure and World-Class Research Facilities

Twenty-first century researchers and the students who will bring new skills into the workforce rely on cutting edge tools. In FY 2006, NSF is placing a high priority on investments in cyberinfrastructure and in unique, widely shared research equipment and facilities

An infrastructure of power grids, telephone systems, roads, bridges and rail lines buttressed this nation's industrial economy and allowed it to prosper. However, cyberinfrastructure – a networked system of distributed computer information and communication technology – is the lynchpin of today's knowledge based economy. In FY 2006, NSF cyberinfrastructure investments total $509 million, an increase of $36 million (7.6 percent) over the FY 2005 level.

Modeling, simulation, visualization, data storage and communication are rapidly transforming all areas of research and education. NSF investments in cyberinfrastructure support a wide mix of projects and encourage participation from broad segments of the research community that rely on such technology as they tackle increasingly complex scientific questions. Thanks to cyberinfrastructure and information systems, today's scientific tool kit includes distributed systems of hardware, software, databases and expertise that can be accessed in person or remotely. In fact, programs such as Teragrid, a multi-year effort to create the world's largest

distributed infrastructure for open scientific research, are specifically designed to transcend geographic boundaries and accelerate virtual collaborations.

NSF is also increasing funding for the Major Research Equipment and Facilities Construction by $76 million or 44%, in FY 2006 for a total of $250 million. There are no new starts, but we will continue to fund ongoing projects. Work will proceed on five major facilities that will serve a spectrum of the science and engineering community. These include world-class astronomy, physics, and geosciences observatories identified as the highest priorities for advancing science and engineering.

- The Atacama Large Millimeter Array (ALMA), in Chile, is a model of international collaboration. It will be the world's largest, most sensitive radio telescope.
- The EarthScope facility is a multi-purpose array of instruments and observatories that will greatly expand the observational capabilities of the Earth Sciences and permit us to advance our understanding of the structure, evolution and dynamics of the North American continent.
- Ice Cube, the world's first high-energy neutrino observatory will be located under the ice at the South Pole.
- RSVP, the Rare Symmetry Violating Processes Project will enable cutting edge physics experiments to study fundamental properties of nature. Studies will probe questions ranging from the origins of our physical world to the nature of dark matter.
- SODV, the Scientific Ocean Drilling Vessel, is a state-of-the-art ship that will be a cornerstone of a new international scientific ocean drilling program. Ocean core sediment and rock collected by the vessel will help investigators explore the planet's geological history and probe changes in the earth's oceans and climate.

Additionally, In FY 2006, NSF will assume the responsibility, from the U.S. Coast Guard, for funding the costs of icebreakers that support scientific research in polar regions; $48 million was transferred for those purposes.

Broadening Participation

To feed our knowledge-based economy, the nation needs to capitalize on all of its available talent to produce a workforce of skilled technologists, scientists and engineers. That means developing the largely untapped potential of those underrepresented in the science and engineering workforce – minorities, women and persons with disabilities. It also means supporting science education and training in all regions of the country – not just at large Universities or in a handful of states.

To achieve these goals, the FY 2006 Request maintains a total investment of almost $400 million. Funding will be targeted to programs with a proven track record of progress in these areas. Included in this is $8 million in additional support from the research directorates that will supplement the Education and Human Resources Account to help achieve our goal of broadening science and engineering participation. Working closely with the directorates offers a dual benefit of providing educational opportunities and hands-on research experience to prepare students for the 21st century workforce.

NSF will invest $396.5 million in a range of programs with proven track records. Several highly successful programs for broadening participation—the Louis Stokes Alliances for Minority Participation, the Alliances for Graduate Education and the Professoriate, the Centers for Research Excellence in Science and Technology (CREST), Robert Noyce Scholarship program, STEM Talent Expansion Program and EPSCoR—just to name a few, are secured in this request. Each of these serve as models for integrating educational and research resources to improve recruitment and retention in science and engineering to all sectors of our diverse population.

Sustaining Organizational Excellence in NSF Management Practices

NSF directly supports over 210,000 scientists, educators and students and processes over 40,000 proposals a year. Balancing the needs of a growing, increasingly complex portfolio with new requirements for e-business practices, security, accountability, and award oversight presents a challenge. NSF sets high standards for its business practices and strives to create an agile, innovative organization through state-of-the-art business conduct and continual review. In order to meet these management goals, NSF will be increasing funding for activities that advance organizational excellence by $46 million, to a total of $336 million. In addition to critically needed upgrades to our information technology infrastructure, this increase will allow for the recruitment of 25 full-time employees – 23 for NSF and one each for the National Science Board and the Office of the Inspector General – which will improve our ability to manage our increasingly complex portfolio.

Expanding our e-government systems and the implementing of our ongoing business analysis recommendations are high priorities for FY 2006.

Over the past two years, as part of the Administrations Program Assessment Rating Tool, NSF has worked with OMB to rate eight of our investment categories. All of these areas have received the highest rating of Effective. As such, NSF programs fall within the top 15 percent of 600 government programs evaluated to date.

Crosscutting Activities

Beyond our budget priorities lie dozens of programs and initiatives that cut across NSF directorates and enrich the overall science and research enterprise. NSF sets priorities based on a continual dialogue and exchange of ideas with the research community, NSF management and staff and the National Science Board. Programs are initiated based on several criteria: intellectual merit, broader impacts of the research, balance across disciplines and synergy with research in other agencies. The Committee of Visitors process ensures a continuous evaluation of our merit review process and feedback on how NSF programs are performing. In FY 2006, NSF will emphasize four crosscutting areas.

Crosscutting areas of emerging opportunity: Over several years, NSF has funded exceptionally promising interdisciplinary efforts aimed at advancing our knowledge, addressing national needs, and probing the grand challenges of science. The FY 2006 request maintains or

increases FY 2005 levels of funding for the following priority areas: $84 million for Biocomplexity in the Environment, $243 million for Nanoscale Science and Engineering, $89 million for the Mathematical Sciences Priority Area and $39 million for Human and Social Dynamics.

International Collaborations: Science and engineering research are increasingly global endeavors. International partnerships are critical to the United States in maintaining a competitive edge, capitalizing on global opportunities, and addressing global problems. The Office of International Science and Engineering's recent move to the director's office, and the budget request reflects this important trend. The FY 2006 budget provides $35 million for NSF's Office of International Science and Engineering.

The recent Indian Ocean Tsunami disaster represents the finest in international cooperation – and clearly demonstrates an international desire to develop scientific methods for natural disaster prediction and ways to reduce losses when such catastrophic events do inevitably occur. A network of more than 128 sensors – which NSF has a 20-year investment in – recorded shock waves from the recent earthquake as they traveled around the earth. This network is the primary international source of data for earthquake location and tsunami warning and its data forged the critical core of the early knowledge of this event. Within days of the disaster NSF research teams deployed to the region to gather critical data before it was lost to nature and reconstruction. Their work will help scientists and engineers better understand the warning signs of natural disasters, the design of safer coastal structures, the development of early warning and response systems, and effective steps for disaster recovery.

Interagency Initiatives: NSF will continue to play a lead role in interagency collaborations to address national needs and take advantage of economic growth opportunities. In FY 2006, NSF investments in the National Nanotechnology Initiative increase by $6 million over FY 2005 levels to total $344 million. NSF participation in the Networking Information Technology Research and Development initiative will increase to $803 million – $8 million over the FY 2005 level. The NSF contribution to the Climate Change Science Program decreases slightly to $197 million.

Homeland Security Activities: The FY 2006 Request includes a $2 million increase for government-wide efforts in homeland security research and development. This $344 million investment will strengthen NSF's commitment to cybersecurity by supporting innovations to secure today's computer and networking systems, embed cybersecurity into future systems and preparing tomorrow's workforce with state-of-the-art security skills.

Conclusion

Mr. Chairman, I've only touched upon the variety and richness of the NSF portfolio. NSF research and education efforts contribute greatly to the nation's innovation economy and help keep America at the forefront of science and engineering. At the same time, NSF supported researchers produce leading edge discoveries that serve society and spark the public's curiosity and interest. Extraordinary discoveries coming from dozens of NSF programs and

initiatives are enriching the entire science and engineering enterprise, and making education fun, exciting and achievement-oriented. In fact, just this month, two of the most widely-read and emailed stories from the national press were the discoveries of NSF-supported researchers.

In one, scientists using new bio-bar-code technology created a detection method for a protein implicated in Alzheimer's disease. It's the first test designed for use in living patients and holds promise for diagnosing Alzheimer's at an early stage. In the second development, scientists generated an entirely new classification system for the brains of birds based on recent studies showing that birds are much closer in cognitive ability to mammals than previously thought. The new scheme will affect thousands of scientists, and help merge research efforts on both birds and mammal. These two examples, fresh off the press, illustrate NSF's motto "Where Discoveries Begin."

Mr. Chairman and members of the Committee, I hope that this brief overview conveys to you the extent of NSF's commitment to advancing science and technology in the national interest. I am very aware and appreciative of the Committee's long-standing bipartisan support for NSF. I look forward to working with you in months ahead, and would be happy to respond to any questions that you have.